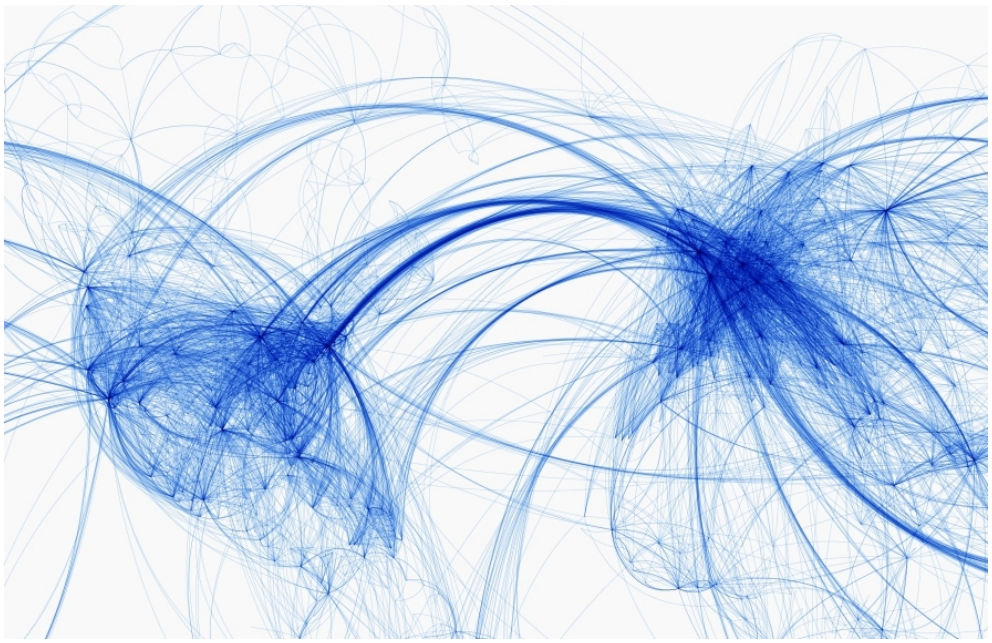
Diploma thesis on the topic

Trapping of pollution by quasi-stationary anticyclones with focus on aircraft emissions from the North Atlantic flight corridor

a thesis submitted to the
Ludwig-Maximilians-Universität (LMU)
München
Institut für Meteorologie
produced at the
Institut für Physik der Atmosphäre
DLR Oberpfaffenhofen



for the degree of
Diplom - Meteorologe
presented by
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July 2009

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The cover shows a visualization of the North Atlantic flight corridor embedded between North American and European air traffic routes. Source and image with the air traffic routes for the whole world in Appendices B and C.

Abstract

It is assumed that aircraft emissions might accumulate in stagnant anticyclones. Emissions like nitrogen oxide and chemical products of them (e.g. ozone) should have higher concentrations within such blocking anticyclones. In this context the occurrence of blocking is examined with the aid of different blocking indices and climatologies already available in the literature. For chosen example cases, in the North Atlantic region, ozone profiles from airborne field campaigns (POLINAT) and ozone sounding platforms (WOUDC) are examined to search for an aircraft emission induced production of ozone.

An analysis of different airmasses and their origin is performed by the calculation of LAGRANTO backward trajectories based on ECMWF wind fields. Taking into account potential vorticity (PV) and pressure along the trajectories together with PV charts and satellite images (EUMETSAT) possible sources for the signal in the ozone measurements are searched. These possible sources are for example boundary layer emissions, that are transported along cold fronts or convectively lifted in thunderstorms, as well as stratospheric intrusions. Some ozone profiles reveal an ozone concentration elevated about 10 nmol/mol in 9 - 10 km altitude (mean altitude for the flight corridor) that could not be traced back to the sources just mentioned. For one of the examples calculations with a Lagrangian particle dispersion model (FLEXPART) with a high resolution air traffic data base (AERO2K) are taken into account for further interpretation.

Finally, recommendations for the planing of an airborne field campaign to measure the ozone production due to aircraft emissions are given.

Contents